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A REVIEW OF POTENTIAL
MODERATING FACTORS IN THE
STRESS-PERFORMANCE
RELATIONSHIP

JUNE 1992

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Technical Report 92-012

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moderator. A conclusion from the findings was that a single unifying construct of perceived control may account for the close relationships among a majority of the moderator variables. It is hypothesized that increased control perceptions could serve to minimize the effects of cognitive, motivational, or affective reactions.

Recommendations regarding current application of the moderator findings focus on statistical control of the levels of each moderator. Implications of moderator variables in the design of training interventions were discussed.

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Technical Report 92-012

EXECUTIVE SUMMARY

PROBLEM

The Combat Information Center (CIC) anti-air warfare environment is characterized by rapidly changing information, complex decision making tasks, ambiguous information, and severe time pressure accompanied by high workload. Recent events (i.e., the USS Vincennes incident) have focused attention on the need to understand the effects of CIC stressors on tactical team decision making in order to design training interventions and decision support systems to enhance performance under stress. In order to interpret the effects of such interventions, it is necessary to identify factors that may obscure (moderate) the relationship of CIC stressors and performance.

OBJECTIVE

This report identifies factors that may moderate the stress-performance relationship, describes potential methodological procedures for experimental control of moderators, and makes recommendations for the application of knowledge about moderators to future Tactical Decision Making Under Stress (TADMUS) research.

APPROACH

A literature review of potential moderators was conducted by searching for key words (e.g., stress, decision making, performance) in the following databases: National Technical Information Service, Defense Technical Information Center, PsychLit, Psychological Abstracts, and Social Sciences Citation Index. Eighty-two empirical articles were identified for this report that had investigated the influence of a moderator variable on the relationship between occupational stress and various stress reaction variables.

The primary goal in the review process was to choose articles that had evaluated moderator effects on the stress-performance relationship. However, this criterion was relaxed to include studies that had evaluated the effect of certain moderators on the stress-attitude relationship, if the study had a potential similarity to the CIC environment. For example, social support is mostly studied in relation to job satisfaction. But, it has potential application to alleviating the effects of stress on team performance in the CIC, if we apply the social support concept to teamwork behaviors (e.g., providing resources to accomplish a task).

FINDINGS

In general, most of the moderator studies found in the review process had evaluated individual difference variables. Seven moderators (social support, locus of control, perceived control, trait anxiety, self-efficacy, self-control, and experience) were identified. Measurement instruments were reviewed for each of the moderators and suggestions for measurement were provided. Implications for CIC team level interaction were discussed in relation to each moderator.

CONCLUSIONS

The literature indicates that in order to understand the stress-performance relationship, it is necessary to recognize critical moderators, and measure and statistically control their effects. Similar conclusions from each literature review led to the hypothesis that a single unifying construct of perceived control may account for the close relationships among a majority of the variables. It is hypothesized that increased control perceptions could serve to minimize the effects of cognitive, motivational, or affective reactions to stress. For example, an increased perception of control would serve to alleviate the detrimental effects of stress on tactical decision making by preserving problem solving and decision making functions, regulating attention and effort, and allaying emotional reactivity.

RECOMMENDATIONS

The recommendations from this report will help to improve the reliability of TADMUS experiments by including evaluation of moderator variables. Recommendations regarding current application of the moderator findings focus on statistical control of the levels of social support, perceived control, self-efficacy, anxiety, locus of control, self control, and experience. Initially, the degree that the seven moderators are related should be investigated. Next, the moderators should be investigated in relation to various stressors (e.g., workload, information ambiguity). Finally, implications of moderator variables in the design of training interventions should be investigated.

Technical Report 92-012

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	9
Problem.....	9
Objective.....	10
Background.....	10
Organization of the Report.....	12
METHOD.....	13
FINDINGS.....	15
Social Support	15
Measurement.....	20
Implications for Team Level Interaction.....	22
Locus of Control	22
Measurement	24
Implications for Team Level Interaction.....	26
Perceived Control	26
Measurement	28
Implications for Team Level Interaction.....	29
Self-Efficacy	30
Measurement	34
Implications for Team Level Interaction.....	36
Self-Control	36
Measurement	37
Implications for Team Level Interaction.....	38
Anxiety	39
Measurement	40
Implications for Team Level Interaction.....	42
Experience	42
Measurement	44
Implications for Team Level Interaction.....	44
CONCLUSIONS.....	47
RECOMMENDATIONS.....	49
Current TADMUS Research.....	49

Technical Report 92-012

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Future TADMUS Investigations.....	49
Convergence of Moderator Variables.....	49
Interaction of Moderators With Stressors.....	49
Implications for Designing Training Interventions.....	50
COORDINATION.....	51
REFERENCES.....	67

LIST OF TABLES

Table

1	Summary of Empirical Studies.....	53
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INTRODUCTION

Although advanced battle management systems were developed to assist Navy personnel to cope with the demands of combat, it is clear that these systems are not, in and of themselves, sufficient aids for dealing with the stressful demands of today's tactical environment. Therefore, there is a need for continued efforts to identify interventions to improve individual and team decision making performance in the modern combat environment. With this need in mind, this report identifies potential factors that may influence the relationship between stressors and tactical decision making under stress.

PROBLEM

The 1991 Persian Gulf conflict between the United States and Iraq has demonstrated the capability of modern military technology to fight wars with speed and efficiency. However, Driskell and Salas (1991) have argued that such technological gains have increased both the stress under which individuals and teams must perform and the potential consequences of inadequate performance. For example, the USS Vincennes incident focused attention on the importance of understanding the effects of Combat Information Center (CIC) stressors on tactical team decision making in anti-air warfare scenarios (Cannon-Bowers, Salas, & Grossman, 1991).

The CIC environment is composed of rapidly evolving and changing information, complex multi-component decision tasks, high information ambiguity, and severe time pressure with high workload (Coover, Cannon-Bowers, & Salas, 1990; Driskell, Hughes, Willis, Cannon-Bowers, & Salas, 1991). In order to make high quality decisions, large amounts of complex information must be processed in a very short period of time (Zachary, Zaklad, Hicinbothom, Ryder, Purcell, & Wherry, 1991).

The functions of the anti-air warfare area (detection, identification, and engagement of aircraft) are carried out via a hierarchal structure of decision makers. A timely and accurate anti-air situation assessment made by the Commanding Officer (CO) is dependent on the interaction and coordination of the Identification Supervisor, the Tactical Information Coordinator, the Electronic Warfare Supervisor, the Anti-Air Warfare Coordinator, and the Tactical Action Officer.

As military technology evolves, the complexity of the CIC environment is likely to increase the demands on teams. Therefore, it is necessary to understand the major factors that influence decision making in order to develop effective interventions to help maintain performance.

OBJECTIVE

The major objective of the Tactical Decision Making Under Stress (TADMUS) program is to enhance the tactical decision making of anti-air warfare CIC teams through the provision of individual and team training principles and guidelines, and decision support and display principles. One of the critical tasks designed to enable this objective is to understand how CIC-type stressors affect tactical decision making. This includes identifying and understanding variables (moderators) that may obscure the relationship between stressors and individual and team performance.

Therefore, the objective of this report was to identify and select relevant moderator variables in order to effectively evaluate the stress-performance relationship in an Anti-Air Warfare (AAW) CIC research setting. In order to achieve this goal, the available literature was synthesized to: (a) identify candidate moderators that may influence the relationship between stress and tactical decision making, (b) make recommendations for measuring candidate moderators, and (c) make propositions for applying our understanding of these variables to the development of training principles and guidelines for CIC teams.

BACKGROUND

The effects of stress have been of interest to scientists for at least fifty years (Singer & Davidson, 1986). During this period, several theoretical positions have emerged concerning these effects. For example, Selye (1956) emphasized a physiological approach that concentrates on the physical and endocrinological responses to the stress demands placed on the human. Because Selye suggested that there is a nonspecific physiological response to demands on the human system, this approach suggests the use of biological or biochemical measurement techniques to provide indices of stress effects.

Researchers who emphasize the importance of situation appraisal as the key element in stress are proponents of the psychological approach (Lazarus & Folkman, 1984). This theoretical position emphasizes the contributions of cognition to the stress response and it typically employs subjective data in the assessment of psychological changes. It suggests that stress results when the individual's assessment of their perceived resources, relative to those required to cope with the situation, do not correspond.

The performance approach defines stress in terms of some decrement in performance in response to stressful conditions (Baker & Chapman, 1962). This position infers the presence of

Technical Report 92-012

stress by observing the decrease in an individual's ability to perform their tasks under the stressful condition.

A final theoretical position maintains an integrative viewpoint that conceptualizes stress as having physiological, psychological, and performance elements. This viewpoint argues that considering each component in isolation fails to give a clear understanding of stress effects. The current document examines stress within this framework. However, for the purpose of application to team decision making, the performance dimension is the most relevant and will be emphasized.

Moderator Variables

Many different stressors have been investigated and it is generally accepted that stress produces performance decrements (Driskell et al., 1991). However, at times stress has been found to enhance performance. For example, Boff and Lincoln (1988) summarized a variety of findings that indicated that alcohol, depressant drugs, fatigue, and sleep loss tend to cause decrements in performance. On the other hand, incentives, stimulant drugs, and heat tend to enhance performance. The effects of noise, anxiety, and time of day are mixed.

The Boff and Lincoln (1988) summary suggests that the results of many stress studies have been equivocal. A number of factors have been suggested as potential causes for these mixed results. While errors in experimental design and difficulties in measurement have been found to contribute to obscuring stressor effects (Laux, 1976), some individual and situational factors have been identified that influence the stressor-performance relationship. Sandler and Lakey (1982) have distinguished between two broad categories of stress moderating factors: (1) such individual dispositional characteristics as traits and coping styles and (2) characteristics of the environment (e.g., social supports). Sandler and Lakey reported that empirical evidence supports that both types of variables moderate the effects of stress. Similarly, Jex and Beehr (1991) have divided moderator variables into demographic characteristics, physical conditions, and personality traits and have summarized evidence concerning the impact of each type.

Sandler and Lakey (1982) have noted that little is known about the process by which moderator effects occur. But, Jex and Beehr (1991) have hypothesized that, because of the impact of moderator variables on the stress process, "not everyone perceiving the same stressors in the work environment will exhibit the same psychological, physical, and behavioral reactions" (p. 339).

Technical Report 92-012

In complex environments such as the CIC, the existence, combination, and interaction of these same factors can serve to obscure the stress-performance relationship. It is important to control the effects of moderating variables in studies of team performance because the effects may be additive across team members. Furthermore, it is possible that some variables that may not be relevant in individual cases will come into play as moderators of the effects of stress on team performance (e.g., team cohesion). This report sought to examine the most relevant moderator variables in order to establish the utility of each for application to team tactical decision making research.

ORGANIZATION OF THE REPORT

The next section describes the methodology for gathering the literature for this report. Following the methodology are seven review sections for each of the moderator variables that were chosen to be most salient for future team tactical decision making research. The conclusions section synthesizes the reviewed literature and the recommendations section provides suggestions for current and future TADMUS research. The last section describes the coordination of the TADMUS effort between the Naval Training Systems Center and the Naval Command and Control Ocean Surveillance Center.

METHOD

The literature review consisted of a search for key words (e.g., stress, decision making, and performance) in the following databases: National Technical Information Service, Defense Technical Information Center, and PsychLit, Psychological Abstracts, and Social Sciences Citation Index. In addition, reference lists of key articles were scanned for relevant citations.

The following steps were followed in choosing articles for this report. First, approximately 800 abstracts were reviewed that had cited stress as the focus of the study. As a result, 300 articles were evaluated that had studied job-related stressors that had potential application to CIC-type stressors. Articles were eliminated that had studied life stressors, family stressors, and other non-occupational stressors. Next, articles were eliminated if they had not investigated interaction effects of moderators with the stressors.

Overall, very few studies exist that have evaluated moderator effects and most of the studies identified evaluated individual difference variables (e.g., perceived control, locus of control). Eighty-two empirical articles were identified for this report that investigated the influence of a moderator variable on the relationship between occupational stress and various stress reaction variables.

The primary goal in the last step was to choose articles that had evaluated moderator effects on the stress-performance relationship. However, this criterion was relaxed to include studies that had evaluated the effect of certain moderators on the stress-attitude relationship, if the study had potential generalizability to the CIC environment. For example, social support is mostly studied in relation to job satisfaction. But, it has potential application to alleviating the effects of stress on team performance in the CIC, if we apply the social support concept to teamwork behaviors (e.g., providing resources to accomplish a task).

Technical Report 92-012

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FINDINGS

Seven potential moderator variables were identified: social support, locus of control, perceived control, self-efficacy, self-control, anxiety, and experience. Table 1 presents a summary of empirical studies reviewed. Following is an in-depth review of the research found for each moderator, with a discussion in each section about measurement recommendations and potential implications of the moderator for CIC team level interactions.

SOCIAL SUPPORT

Social support has often been identified as a moderator of stress effects. This variable is defined by Caplan and Killilea (1976) as:

"...attachments among individuals or between individuals and groups that serve to improve adaptive competence in dealing with short-term crises and life transitions as well as long-term challenges, stresses and privations through (a) promoting emotional mastery, (b) offering guidance regarding the field of relevant forces involved in expectable problems and methods of dealing with them, and (c) providing feedback about an individual's behavior that validates his conception of his own identity and fosters improved performance based on adequate self-evaluation" (p. 41).

In general, each of these components of support can be seen as resources contributed by others to help an individual deal with the situation at hand.

In terms of measurement, it has been argued that subjective or perceived support measures are more appropriate than objective measures (House, 1981), because social support is probably only effective if it is perceived as such by the individual. Therefore, it is likely that the salient aspect of social support is not the amount of support provided by others, but the amount perceived by the individual. The measurement of social support should include an index of perceptions concerning the quality as well as the quantity of the supporting relationships (House, 1981). Generally, the research reviewed will discuss social support from two perspectives. Social support is discussed in relation to the buffering hypothesis and as a variable which intensifies the effect of stressors. Research from both of these positions will be reviewed.

It has been hypothesized that social support serves as a "buffer" with respect to the potential effects of stress (Caplan, 1974). This "buffering hypothesis" states that social support

acts to suppress the subjective experience of strain experienced in response to a stressor. In this context, the amount of stress imposed by a stimulus has been described as the relationship between the resources possessed by the subject and those required to cope with the stimulus condition (Lazarus & Folkman, 1984). Therefore, the buffering hypothesis suggests that social support increases the resources available to the individual, thereby reducing the amount of subjective stress experienced by the individual.

Several studies have provided support for the buffering hypothesis. For example, Solomon and his colleagues investigated the extent that objective and subjective stress measures were predictive of combat stress reactions among soldiers in the 1982 Israeli-Lebanon War (Solomon, Mikulincer, & Hobfoll, 1987). The predictability of Post-Traumatic Stress Disorder (PTSD) occurring in those previously diagnosed with Combat Stress Reaction (CSR) was also explored. The results indicated that, although both subjective and objective measures of stress were predictive of CSR and PTSD, the subjective measures were stronger in predictive power. Post traumatic stress disorder and combat stress reaction were found to be linked, while the diagnosis and severity of PTSD was predicted by the existence of CSR. The authors suggested the following emergent pattern: A soldier becomes at risk when exposed to intense combat without the previous establishment of social or functional bonds with members of his unit. If the soldier experiences especially intense combat while lacking social support from his group he is at greater risk for developing CSR, thus increasing his chances for developing PTSD. The authors cautioned that while the above scenario is consistent with their data, no causal order can be established.

Etzion (1984) conducted a field study to assess the effects of social support on the response of males and females to occupational and life stress experiences. The study utilized 657 Israeli managers and human service professionals. Measures were taken of life and work stress, availability of social support in lives and work, and degree of burnout. He found that women experienced more life stress and subsequent burnout than did men in this sample, but no significant difference in reported levels of work stress between men and women was found. While social support was found to serve as a moderating effect for both men and women, the sources of the effective support differed. Specifically, men's work stress was moderated by social support in the workplace, whereas in women, the effects of work stress were moderated by social support received in their lives outside the workplace. Thus, Etzion's data also supported the hypothesis that social support serves to buffer individuals from the effects of stress.

Technical Report 92-012

The results of a study by Koeske and Koeske (1989) indicated that social support, especially support from co-workers, helps to buffer the negative impact of workload on burnout. In this study, data were gathered via questionnaire from 216 social workers. For individuals with low social support in low accomplishment conditions, workload produced significantly greater stress. These research findings are consistent with the predictions of the buffering hypothesis.

The results of a study by Abdel-Halim (1982) were mixed regarding the effects of social support. In this experiment, 89 middle-lower managerial personnel in a heavy equipment manufacturing firm were surveyed, in order to assess the effects of social support on the relationship between role conflict and job anxiety. The results indicated that a positive relationship existed for persons with strong work-group support, and a negative relationship was found for those with weak work-group support. Furthermore, individuals who experienced high levels of role conflict and had high consideration superiors were more intrinsically satisfied than individuals with low consideration superiors. Social support from the work group and supervisor differed in their effects on the relationship between negative work outcomes, stress variables, and positive work outcomes. The author cautioned that the results should be interpreted with caution, since the sample was fairly homogeneous and the data were derived from self-report measures. Although the results of this study are mixed, they do indicate that social support has some measurable buffering effect.

The moderating effects of social support have been further clarified by the results of an investigation of responses to the occupational stress produced by role ambiguity (Beehr, 1976). Among other things, this research sought to determine the relationship, if any, between role ambiguity and job satisfaction. The three situational characteristics that were hypothesized to moderate this relationship were group cohesiveness, supervisor support, and autonomy. Of most importance to the current discussion, the results indicated that supervisor support did not show a moderating effect, while work group support moderated the relationship between role ambiguity and job satisfaction in the predicted direction. (Autonomy was found to have the strongest and most consistent moderating effect between role ambiguity and role strain.) These results indicate that certain aspects of social support may have greater moderating effects than others, and specifically that organizations should try to increase the support provided by work groups, in order to reduce the role strain associated with role ambiguity.

Technical Report 92-012

Although there has been substantial support for the buffering hypothesis, an alternative hypothesis has also been proposed that states that social support intensifies subjective strain in the presence of a stressor. La Rocco and Jones' (1978) study provided evidence for what they term the direct effects hypothesis. The subjects were 3,725 enlisted shipboard Navy personnel ranging from the lowest to the highest pay grade. Results indicated that neither leader nor co-worker support was able to alleviate the negative stress effects produced by conflict and ambiguity. In fact, a negative relationship between high co-worker support and job satisfaction was reported. The authors hypothesized that negative stress effects may be most easily alleviated if sources of conflict are addressed directly and role clarity increased. This study failed to support a buffering hypothesis of social support.

Hobfoll and London (1986) examined the immediate stress resistance of 56 Israeli women with loved ones mobilized into the Israeli Defense Forces. Coping resources and psychological distress were assessed for each subject during the first week of the June 1982 Israel-Lebanon conflict. Results indicated that social support was related to increased psychological distress. The authors attributed these results to a hypothesized "pressure cooker" effect that evolved, due to the rapid spread of war rumors and greater exposure to the sorrows of others by those women with more intimate relationships. The authors also suggested that social support may have a negative impact on women with high self-esteem who would choose to approach life challenges independently. This research also provided evidence that social support may serve to intensify stress effects.

Kaufmann and Beehr (1986) explored the relationship between social support and job stressors such as the underutilization of skills, quantitative person-environment fit, and job future ambiguity. Their subjects were 102 nurses from a midwestern medical center who were participants in a stress workshop. The authors hypothesized that social support would moderate the relationship between stressors and strains in such a way that less strain would occur in the presence of high social support. Results however, were contrary to this hypothesis. All of the resulting interactions were in the opposite direction. The presence of social support served to increase the amount of perceived stress. The authors caution that the results of their research should not imply that the presence of social support will always yield increased strain in the face of a stressor.

Supervisor support in the organizational climate has been explored in relation to workload, tension, and coping (Kirmeyer & Dougherty, 1988). Sixty police radio dispatchers were observed and rated as to their perceived load, tension-anxiety, and coping

actions. Support from superiors was found to moderate the effects of objective and perceived loads. Dispatchers with high social support and under high perceived load engaged in more coping actions and felt less tension-anxiety than dispatchers with low social support. When perceived workload was low, no differences were found. The authors suggested that future research take a comprehensive approach toward examining how support affects coping and how individual and organizational effectiveness are impacted.

One characteristic of supervisor support which might prove especially helpful is feedback or knowledge of results. For example, Wilkinson (1963) investigated the interaction of noise with sleep deprivation and knowledge of results in two experiments. In experiment one, sleep deprivation was associated with a decrease in correct responses and an increase in gaps in both quiet and noise conditions. Under normal sleep conditions, noise increased the number of errors in 11 out of 12 subjects. However, under sleep deprivation conditions, noise failed to increase the number of errors. Experiment two added a knowledge of results variable to the conditions already present in experiment one. With knowledge of results there was an increase in gaps in the noise condition, whereas gaps were not affected in the noise condition with no knowledge of results. Therefore, knowledge of results reduced gaps more in quiet than in noise conditions. Knowledge of results also resulted in fewer errors under quiet, but not noisy conditions. Wilkinson concludes that sleep deprivation reduces the effect of noise on performance, while knowledge of results increases the effect of noise on performance. This indicates that the effects of sleep deprivation and knowledge of results oppose each other. Although knowledge of results was detrimental in the noisy condition, this study indicated that this same feedback in quiet conditions is beneficial.

Reviews of the social support literature have generally concluded that the majority of research results support the buffering hypothesis (Cohen & Wills, 1985). However, some of the studies described above serve to demonstrate that social support is not a panacea to the reduction of stress effects. In fact, social support may be an effective moderator of stress only in relatively specific situations. For example, bearing in mind House's (1981) assertion that social support is effective only when perceived as such by the subject, studies that assess only the presence of "supportive resources," such as Hobfoll and London (1986) described above, may be at risk for underestimating the buffering effects of social support.

It should also be noted that even perceived support is likely to be effective only when the nature of that support

Technical Report 92-012

directly assists in coping with the stressor (see Bowers & Gesten, 1986 for an experimental demonstration). Therefore, social behaviors may only be stress-reducing when they provide additional coping resources.

Measurement

Of all the moderators discussed here, social support has received the most attention. Therefore, many measures have been developed for its assessment. This section discusses several of the better instruments (in terms of psychometrics and content) and makes recommendations regarding the questionnaire that appears most serviceable for stress-performance researchers.

The Inventory of Socially Supportive Behaviors (ISSB) (Barrera, Sandler, & Ramsay, 1981) was developed in order to assess specific behaviors that individuals perform for one another that provide support (i.e., loaning money, providing feedback). The initial investigations with the instrument were conducted using college students. The instrument was created particularly to: (a) be behaviorally specific, (b) avoid applicability to a specific population, and (c) omit reference to statements of psychological adjustment. Responses to the 40 item scale are ratings that indicate the frequency with which the scenario of the item occurred on a 5-point scale. Test-retest reliability of the total scale was .88 and coefficient alpha values of .92 and .94 were calculated for the first two administrations of the scale (Barrera et al., 1981). Concurrent validity of the scale was confirmed based on significant correlations with available and actual social support network size derived from the Arizona Social Support Interview Schedule (Barrera, et al., 1981). A factor analysis of the scale was performed by Barrera and Ainlay (1983). Four factors were extracted and a factor loading cutoff value of .40 was used in factor identification. The factors were labeled as directive guidance, nondirective support, positive social interaction, and tangible assistance. The authors note that socially supportive behaviors may indeed be classified into meaningful categories. The length and psychometric properties of the ISSB indicate that it may be a desirable scale for the assessment of social support within the military environment. Its focus on specific behaviors is also a positive point.

A scale of social support has also been developed by Procidano and Heller (1983). The Perceived Social Support Scale (PSS) was designed to yield subjective ratings of the individual's perception of support, feedback, and information received from friends and family. The authors state that a distinction between social support received from family and friends is a necessity since individuals may benefit from

Technical Report 92-012

different sources. The scale was originally developed and validated utilizing undergraduate students. Test-retest reliability of .83 was demonstrated on the 35-item preliminary version of the scale, and a Cronbach alpha of .90 was computed (Procidano & Heller, 1983). The original 35 items were reduced to 20, and these items were duplicated to refer to family and friends. Responses for each of the 20 item scales were given in a yes, no, or don't know format. Cronbach's alpha for the revised "friend" version of the scale was .88. Factor analysis of each scale yielded one factor, as expected. A positive relationship between the "friend" scale and the Dating and Assertion Questionnaire (that assesses social competence) was demonstrated, while a negative relationship was obtained between the "friend" scale and lack of self-confidence. Although the PSS-Friends scale is a manageable length and has good psychometric properties, the content of the items appear to measure less tangible social support resources than the ISSB, perhaps reducing its utility for military research.

The Social Support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983) consists of two separate parts: a list of individuals in the network and 27 items to assess overall level of satisfaction with support received for each item. A test-retest reliability estimate of .90 was computed for the scale's "Number" component and a test-retest reliability estimate of .83 was computed for the "Satisfaction" scale (Heitzmann & Kaplan, 1988). Internal consistency estimates .97 and .94 were obtained, respectively. A correlation of -.22 was computed as a measure of the scale's concurrent validity with the Multiple Affect Adjective Check List (Heitzmann & Kaplan, 1988).

The Inventory of Socially Supportive Behaviors appears to be one of the best existing instruments for the assessment of social support. The psychometric properties of the scale are acceptable and its length would allow for speedy administration. The main strength of the scale is its assessment of specific behaviors. The social support literature has indicated that the effectiveness of social support is determined by the degree that specific helping behaviors are given by individuals. However, given that social support is most useful when tangible helping behaviors are provided, it would appear that a questionnaire that addresses these tangible sources of support within military environments should be devised. The scale should list behaviors that would serve to help others and measure the degree that individuals had been recipients of the behaviors. Although the ISSB is a useful instrument for the assessment of social support, optimal measurement of social support may be accomplished through the development of a similar questionnaire tailored specifically to the military environment.

Implications for Team Level Interaction

Team level implications are more evident for social support than for most other moderators. Since social support involves more than one individual, by definition, it is easier to consider implications of various levels of social support. It is hypothesized that teams with high perceived social support will demonstrate better decision making performance when confronted with a stressor than teams with low perceived social support. Task related sources of social support will result in better tactical team decision making performance than non-task related social support sources, thus increasing the individual's confidence in his or her ability to perform.

Social support is an especially promising variable in regard to tactical team decision making within the CIC. Given the functional interrelationship of CIC teams, high levels of perceived social support would appear to increase team effectiveness. Since the team members are dependent on one another, a socially supportive relationship with those same members could decrease the effects of stress on team tactical decision making performance.

LOCUS OF CONTROL

Another concept that has been investigated as a moderator of stress is locus of control. Locus of control is defined as "the extent to which people perceive that events are contingent on their own behavior (internal locus of control) or that events are determined by other powerful individuals, fate, or chance (external locus of control)" (Rotter, 1966). An important aspect of stress research may be the degree to which individuals perceive stressful events as being within or outside their control. This may apply to incidents within the individual's occupation or within their life in general.

While some may question the generalizability and relevance of life events research to the current document, past authors have recognized the applicability of life events research to individuals' occupations. Quick and Quick (1984) argued that in order to examine the individual's stress experience most thoroughly, it is necessary to examine an individual's stress and strain away from work as well. Consideration of negative life events may be particularly appropriate for workers in the Navy environment. Factors such as separation from loved ones, change in living arrangements, and other stressors that traditionally have been considered to be negative life events are frequently present in deployed forces in addition to the more acute stressors typically considered in the stress/performance literature. It is also argued that stressful life events in an

Technical Report 92-012

individual's personal life have an effect on their performance and work adjustment, as well. It is for this reason that some selected studies involving negative life events as a stressor have been included in this discussion.

Johnson and Sarason (1978) explored the relationship between negative life events and locus of control in order to test the hypothesis that negative life events would be most stressful for individuals who perceived themselves as having little control over their environment. They specifically predicted that life change, anxiety, and depression correlations would be significant only for those individuals who were external in their locus of control. The results of this investigation provided support for this hypothesis. Individuals who perceived themselves as having control over life events were less likely to suffer strain in response to negative life events. Thus, these results indicated that locus of control may act as a moderator of the stress/strain relationship.

Locus of control also served as a moderator of stress in a study conducted by Perrewe (1986). Consistent with the findings of Johnson and Sarason (1978), managers who had an external locus of control reported less satisfaction and greater perceived workload stress than did those subjects with internal locus of control.

Houston (1972) proposed that individuals who have an external locus of control would manifest more physiological arousal under a condition of threat than would individuals with an internal locus of control. However, the results of a study by Houston indicated that subjects who were external in locus of control exhibited less arousal to stress than internal subjects. These results are contrary to most findings.

Vitaliano, Russo, and Maiuro (1987) investigated the moderating effects of locus of control on life events with a component of threat. The subjects were instructed to appraise the life events in terms of the challenge they imposed. The subjects were 433 first and second year medical students. Results indicated that individuals with an external locus of control were 10 times more likely to perceive a stressor involving personal mastery as threatening, rather than challenging. Subjects with an internal locus of control were twice as likely as externals to feel challenged when confronted with a performance stressor. These results were consistent with the majority of the above findings indicating that individuals who have an internal locus of control are more likely to perceive certain stressors as more manageable, thereby reducing the severity of reactions to these stressors.

Technical Report 92-012

Lefcourt, Martin, and Saleh (1984) showed that internal locus of control subjects are better able to make use of social support. Subjects were 46 undergraduates who agreed to participate in a life stress study. Results indicated that individuals who have an internal locus of control obtained greater benefits from social support than individuals with an external locus of control. Possibly, individuals with an internal locus of control, by regarding themselves as responsible for their own failures, gain more useful information from others when in distress, because they offer alternative perspectives that help them deal with the guilt they feel after failing. The authors also concluded that the moderating impact of social support occurs for individuals who are more autonomous and less generally affiliative. The authors suggested that social support may have the most benefit for persons who are "more instrumental and sparing in their approach to social interactions" (p. 378).

Sandler and Lahey (1982) utilized 93 undergraduate students to investigate the effects of locus of control on the relationship between psychological disorder and negative life events, perceptions of control over negative life events, and the impact and receipt of social support. Individuals who were external in locus of control had higher correlations between negative life events and anxiety. Individual's locus of control also appeared to affect the perceived quantity and importance of social support. The buffering effect of social support was found only with those individuals who were internal in locus of control. This study lends credence to the idea that two variables interacting may serve to moderate stress effects more than a single variable acting alone.

Measurement

Whereas social support has suffered from some lack of definition and this has affected its measurement, locus of control is relatively well defined and, therefore, easily measured. The remainder of this section discusses two scales for the assessment of locus of control and a specific recommendation for research with military applications.

The instrument most often used in the assessment of locus of control is Rotter's Internal-External (I-E) scale. Rotter (1966) developed the scale in order to quantify the degree that an individual feels that rewards are controlled by external forces versus their being contingent on one's own behavior. The scale was derived from an original questionnaire that attempted to assess separate areas of achievement, general social and political attitudes, and affection. The 100-item forced-choice format attempted to control for the presentation of socially desirable answers. Subsequent reduction to 60 items following

Technical Report 92-012

the scale's factor analysis revealed the inadequacy of the subscales. For this reason, the idea of separate subscale assessment was abandoned. The final version of the I-E scale contains 29 forced-choice items, 6 that are meant to disguise the nature of the test. Rotter (1966) noted that the scale assesses the individual's belief about the actuality of their world as opposed to their preference for internal or external control. Internal consistency measures have ranged from .65 to .79 and test-retest reliabilities from .49 to .83. Rotter (1966) reported that Franklin (1963) performed a factor analysis and obtained one general factor on which all the items significantly loaded. This factor accounted for 53 percent of the total scale variance.

Rotter has argued that the most important way to assess construct validity of the scale is by relating it to the degree to which individuals attempt "to control their environment in important life situations" (Rotter, 1966, p. 19). This assumption was tested by the work of Seeman and Evans (1962). They had 43 matched pairs of tuberculosis patients investigated as to the extent of involvement they maintained regarding their condition. The measures taken were: the amount the patients knew about their condition, how much they asked about their condition, and how satisfied they were with the feedback they received regarding their illness. Results of the study indicated that internals asked more questions about their condition, knew more about it, and exhibited less satisfaction with the amount of feedback they received regarding their condition. It would appear that this study supports Rotter's supposition regarding the degree of control over life situations undertaken by individuals who have an internal locus of control. The I-E scale appears to have adequate psychometric properties and the length is quite manageable.

Another scale that assesses locus of control is the James (1957) Internal-External Locus of Control Scale (Robinson & Shaver, 1973). The questionnaire contains 60 items, 30 of which are fillers. Unlike the Rotter scale, this questionnaire presents the items in a Likert format from 0 (strongly disagree) to 3 (strongly agree). Split-half reliabilities of the scale are reported to range from .84 to .96, while test-retest reliabilities range from .71 to .86 (Robinson & Shaver, 1973). The validity of the instrument has not been determined, but correlations of .64 with the Rotter scale have been obtained (Robinson & Shaver, 1973). Factor analysis has yielded a simpler factor structure for the James' scale than Rotter's. Robinson and Shaver (1973) indicate that it may be reasonable to delete the filler items if a shorter form of the scale is desired. The Likert scale format may allow individuals to equivocate regarding their control perceptions while the Rotter format prevents this.

Technical Report 92-012

While the two scales have similar psychometric properties, the strength of the available validity data suggests that the Rotter I-E Scale appears to be the most potentially valuable instrument for the assessment of individuals' locus of control. The scale's validity and reliability have been demonstrated, and the length of the scale will allow speedy administration. The widespread use of the Rotter I-E Scale in the past also indicates that this instrument is a valuable tool in the assessment of locus of control as defined by Rotter (1966).

Implications for Team Level Interaction

The relationship of locus of control to interactions at the team level are somewhat less clear than for social support. However, some general hypotheses can be made. It is hypothesized that CIC teams comprised of members internal in locus of control will demonstrate performance superior to external locus of control teams under stress. Although members should be internal in their locus of control, their level of internality will be most effective in a team decision making situation if the members internality is not too extreme.

PERCEIVED CONTROL

Perceived control can be defined as the extent to which an individual believes that he or she directs the events in the environment. Perceived control differs from locus of control because it emphasizes the belief that the individual has at his or her disposal a response that can influence the aversiveness of the event. Investigations regarding perceived control focus not only on the individual's actual control, but on their beliefs regarding the situation. Bandura and Wood (1989) reported that perceived controllability effects have been experimentally studied most often in relation to reactions to stress. In general, past research has indicated that individuals who are led to believe that the occurrence of aversive events in the environment are personally controllable display less performance impairment and lower autonomic arousal than individuals who see the events as beyond their control. This highlights the importance of controllability as a moderator under conditions of stress.

In a study by Solomon, Holmes, and McCaul (1980), 89 male undergraduates were required to perform tasks that varied in difficulty and level of controllability of threat. Electric shock was presented as either under the individual's control or as a random circumstance not under their control. Results indicated that controllability over the threat decreased anxiety, but only when the control required little effort. However, when control was difficult to exercise, subjects reported as much

Technical Report 92-012

anxiety as those in the threatened group with no control. The authors concluded that control over a threatening situation may only reduce anxiety if the control is easy to achieve. Since digit span performance was consistent over conditions, it was not taken into consideration for the analyses.

Glass and Singer (1972) investigated the relationship between exposure to controllable and uncontrollable noise and subsequent performance on two cognitive tasks. Subjects who were exposed to uncontrollable noise had significantly decreased performance in problem solving as measured by attempts to solve puzzles. They also performed more poorly on a proofreading task in the uncontrollable noise condition. The authors concluded that their lower performance resulted from feelings of helplessness that developed due to their lack of control over their environment.

Keinan (1987) utilized 101 undergraduate subjects who were required to perform a cognitive task under varying conditions of stress controllability. This study also considered the frequency with which individuals engaged in a systematic consideration of all the relevant alternatives. Contrary to the findings of Solomon, Holmes, and McCaul (1980), stressor controllability had no effect on performance. However, only individuals who were exposed to the stress condition exhibited a significant tendency to offer solutions before scanning all of the potential solutions. Subjects under the no stress condition scanned the alternatives in a systematic fashion. Patterns of scanning alternatives were discovered to be correlated with accuracy of solutions to decision problems. While this research found no evidence for the moderating effect of controllability of the stressor on performance, it does provide useful information regarding the consideration of alternatives by the individual and evidence that this process is necessary for effective decision making. It is also of interest to note that the component of decision making that was neglected during stressful situations was the scanning of alternatives (Keinan, 1987). Given this information, further research may indicate the scanning of alternatives (situational awareness) to be critical during the training of individuals who are forced to arrive at decisions under stress.

The relationship between perceived role stress, satisfaction, and psychological well-being were explored by Tetrick and LaRocco (1987). Their research investigated the moderating effects of understandable, predictable, and controllable work situations. Subjects were physicians, dentists, and nurses of a large Naval hospital. Understanding and control proved to have moderating effects on the relationship between perceived stress and satisfaction. Direct relationships

Technical Report 92-012

between perceived stress and understanding, prediction, and control were found; however, only control had a significant direct relationship with satisfaction. The authors propose that understanding and predictability of events, and control over outcomes in the work environment may "serve as antidotes to occupational stress."

Measurement

For the most part, the assessment of perceived control has been typified by the development of questions specific to particular research investigations. For this reason, this section reviews the questions used in several studies and makes specific recommendations for the development of measurement instruments for the assessment of perceived control. The use of locus of control scales for the assessment of perceived control is also discussed.

Tetrick and LaRocco (1987) developed the following six questions to measure perceived control:

"To what extent do you have influence over the things that affect you on the job?

To what extent do you have input in deciding what tasks or parts of tasks you will do?

To what extent do you have the opportunity to take part in making job-related decisions that affect you?

To what extent can you set your own work deadlines?

To what extent does your job allow you the opportunity for independent thought and action?

To what extent do you control the pace and scheduling of your work?" (p. 543).

Subjects indicated the degree that they had control in each of the situations on a seven point scale (ranging from 1=very little to 7=a great extent). The questions were developed based on the definition of control provided by Sutton and Kahn (1986). In this case, the authors constructed their own measure of perceived control. These items address the perceived controllability of events in the work environment. Since perceived control may be measured in variable environments, it may prove necessary to design questionnaires that are selective in their scope.

Keinan (1987) investigated the effectiveness of their control manipulation through the use of three questions. Subjects threatened with electric shock were asked: "(a) to what extent did you believe that you could control the electric shocks? (b) to what extent do you attribute the fact that you have not yet received any electric shocks to luck or fate? (c) to what extent do you attribute the fact that you have not yet

Technical Report 92-012

received any electric shocks to your success in performing the task?" (Keinan, 1987, p.640). Subjects responded on a seven point scale (1=to a very minor extent and 7=to a very great extent). Keinan (1987) also developed his own questionnaire based on the particular subjects' situation. This again illustrates the necessity of designing situation specific measures of perceived control.

It can also be hypothesized that locus of control measures may be used as global measures of perceived control. Individuals who obtain scores indicating an internal locus of control could be said to have higher levels of perceived control on a global level than persons with an external locus of control.

There appears to be a need for the development of situational measures of perceived control. These should be specific enough to allow optimal measurement of the situation, yet global enough to allow the generalizability of the scale to more than one situation (i.e., threat). These questionnaires should be developed using items constructed for particular studies and locus of control scales as models. As noted previously, Likert response formats would allow variability of response across subjects. This will enable researchers to investigate gradations of performance across levels of control. Ideally the questionnaires would contain 25 to 50 items, which will limit administration time. This will be best accomplished by developing enough initial items so that poor items may be dropped after preliminary investigations. The initial items should be administered to a large enough subject pool (e.g., n=250) that sufficient variance exists for the establishment of reliability. Following this administration, items without sufficient variability of response may be dropped as ineffective. The final version of the scale can again be administered to establish its reliability and validity. Given the recognized importance of perceived control within the literature, it is apparent that there is a need for the development of effective perceived control measures. As previously mentioned, the measures should strive for an optimum balance between generality and specificity.

Implications for Team Level Interaction

The team decision making implications for perceived control are very similar to those for locus of control. Although CIC teams with high levels of perceived control are hypothesized to perform better under stress than low control teams, there is probably an optimal level such that there is a possibility of control perceptions being too high. The concept of "team level control" is one which would relate to the perceptions of team members regarding the team's control over situations. Teams that

rate themselves as having high levels of team level control are hypothesized to perform better under stress than teams with little team level control. Again, the optimal level would appear to be one where the control perception is fairly high, but not so high as to result in feelings of invincibility. This may result in carelessness on the part of the team.

SELF-EFFICACY

Related to the construct of perceived control is that of self-efficacy. Self-efficacy can be defined as "the strength of one's conviction that he or she can successfully execute a behavior required to produce a certain outcome" (Bandura, 1977). Bandura asserts that an individual's expectations of mastery affect the initiation and continuance of coping behaviors. If individuals have high expectations regarding their ability to perform a task successfully, they are more likely to attempt the task and to sustain their efforts once they have begun. These expectations determine the amount of effort individuals will expend and how long they will persist in the presence of obstacles and aversive circumstances. Bandura (1977) also argues that efficacy expectations vary along several dimensions (e.g., magnitude, strength, and generality). The magnitude of expectations refers to the degree of difficulty of the tasks to be performed and generality refers to the range of tasks that the expectations cover. Bandura also proposes that expectations vary in strength. The strength dimension refers to the extent that expectations will maintain their existence under conditions of disconfirming evidence. Generality refers to the extent that expectations extend beyond the particular treatment situation. However, Bandura notes that an individual's expectations alone are not sufficient to explain performance. It is assumed that sufficient skill level and motivation are present as well. Given sufficient skill and motivation, according to Bandura, the deciding factor regarding performance is the individual's self-efficacy level regarding the task.

Bandura (1988) argued that it is the individual's perceived self-efficacy of control over potential threats that plays a central role in anxiety arousal. Threat is perceived when there is a discrepancy between the individual's perceived coping abilities and the potentially harmful characteristics of the environment. Bandura suggests that control over anxiety requires both behavioral and cognitive coping efficacy, in the form of control over dysfunctional apprehensive cognitions. In other words, individuals who believe they can cope with threatening situations are not likely to engage in apprehensive thoughts or to be anxious. Bandura further states that it is not necessarily the existence of the cognitions but the inability of the individual to stop the thoughts that result in anxiety.

Technical Report 92-012

Bandura's theories of anxiety in response to stressful conditions and self-efficacy are especially relevant to the investigation of moderators of stress and performance. An understanding of both the overt and covert behaviors that potentially alter performance in stressful situations is of utmost importance in the design and implementation of methods to optimize team tactical decision making performance. Generally, research regarding self-efficacy is conducted in relation to measures of performance.

Kent and Gibbons (1987) explored the applicability of self-efficacy to influence negative cognitions in dental patients. Measures were taken of subjects' dental anxiety, number of negative self-statements about their dental appointment, and their perceived ability to control their thoughts. The authors sought to test the applicability of Bandura's self-efficacy theory to the control of negative cognitions, and to investigate the extent of negative thinking in subjects with varying levels of anxiety. They found that individuals with low anxiety experienced fewer negative thoughts than those with moderate or high anxiety. The low anxiety subjects also reported more control over their thoughts. When the number of negative thoughts was controlled, the difference between the anxiety groups was maintained. However, when self-efficacy was controlled for, the difference in negative thinking between anxiety levels was no longer significant. The authors suggested that these results indicate a closer relationship between anxiety and thought processes than to thought content. This research supports the application of Bandura's self-efficacy theory to the control of thought as well as behavior. Self-efficacy in relation to thought control would appear to have potential for application to team decision making research.

Self-efficacy has most often been studied in relation to overt performance. Weinberg, Yukelson, and Jackson (1980) investigated the effect of public and private efficacy expectations on the competitive performance of a muscular leg-endurance task. Subjects were assigned to either a low or high self-efficacy condition. Self-efficacy was induced by having subjects compete against a confederate who was introduced as a varsity track athlete or an individual with a knee injury. Results indicated that the subjects in the high self-efficacy group performed better than the low self-efficacy subjects. A significant interaction between sex and self-efficacy was also indicated. There was a significant difference between low and high self-efficacy males' performance, whereas, no difference was seen for low versus high efficacy female performance. These results are consistent with the majority of research regarding self-efficacy that indicates high self-efficacy beliefs as predictive of superior performance.

Technical Report 92-012

Lee (1982) investigated self-efficacy as a predictor of performance in competitive gymnastics. He sought to test Bandura's theory that an individual's expectations are better predictors of their behavior than their previous behavior. Results indicated that the subjects' performance predictions were accurate in relation to their subsequent performance. The author notes that these findings are consistent with those of previous investigations in that efficacy was a good predictor of performance. Lee also proposes that it may be possible to improve performance by influencing individuals' efficacy expectations in addition to their physical training. This article lends further support to the moderating effects of self-efficacy on performance.

Barling and Abel (1983) investigated the relationship of self-efficacy to the performance of tennis players. Response-outcomes and valence expectancies were also investigated. Results indicated that self-efficacy beliefs were consistently related to various aspects of the subjects' tennis performance. The authors noted that this research adds to the generalizability of self-efficacy. Valence expectancies and response-outcomes were investigated in order to establish that self-efficacy beliefs are the most closely associated with performance. Self-efficacy beliefs were related to behavior while response-outcomes and valence expectancies were not. Barling and Abel (1983) stated that these results prove the utility of self-efficacy theory for applications other than pathological behaviors, and that the critical role of personal mastery expectations is supported by their findings.

The literature indicates that self-efficacy is a potential moderator of performance under stress. Although the majority of investigations have been therapeutically or psychomotor performance related (i.e. competition), the theory has implications for application in other areas as well. For example, Cannon (1988) investigated the relationship between self-efficacy and task specific self-esteem in the performance of a creative thinking task. Initial levels of self-efficacy and task specific self-esteem were found to be significantly related to performance, which indicates that self-efficacy is a viable construct for application to research regarding cognitive performance.

Bandura (1982) argues that people often do not perform optimally, even when they know what they should do. That is, appropriate levels of performance may not be obtained even when individuals possess the necessary component skills, knowledge, and transformational capabilities. Further, Bandura suggests that this is due to the self-referent thought that occurs between thought and action. It is at this point that motivation and

behavior are affected by the individual's self-efficacy perception. Given this, implications for training can be hypothesized. If skills and knowledge training are not judged sufficient for adequate performance, it then becomes necessary to address the mechanism related to self-efficacy beliefs. It could be suggested that a training program that seeks to train only knowledge and skills will prove to be only marginally effective at increasing self-efficacy.

Much of the past research addressing this issue has been performed in the area of cognitive-behavioral theory. The performance of athletes has been of interest as well. Feltz, Landers, and Raeder (1979) sought to compare various modeling techniques, in order to enhance self-efficacy in a high-avoidance motor task. The effectiveness of participant, live, and videotaped modeling on the learning of a springboard-diving task was compared. The strength of self-efficacy resulting from each technique was also investigated. The authors' hypotheses that the participant modeling group would have significantly better performance and show stronger self-efficacy expectations were supported. This can be taken as evidence that adequate skills and knowledge are not sufficient for superior performance, since all training conditions in the study were designed to teach requisite skills and knowledge. Bandura (1977) argues that performance accomplishments are most influential in the development of self-efficacy beliefs. These are provided by personal mastery experiences that enable the individual to perform the behavior until successful (i.e., participant modeling). There are three other ways that individuals can acquire judgements about their self-efficacy. Vicarious experiences (those where the individual witnesses others perform successfully) can alter self-efficacy expectations (Bandura, 1977). Information regarding one's self-efficacy can also be gained through verbal persuasion and physiological feedback. Verbal persuasion is typically most useful with individuals who already have some reason to believe that they are effective in their actions. In terms of physiological response, when high arousal is present individuals label the situation as stressful. Through the cognitive integration of each of these sources of information, self-efficacy expectations are formed.

One component of self-efficacy building that Bandura discusses is that of proximal goal setting and attainment. Bandura (1982) argues that distal goals (i.e., those accomplished in the distant future) are too remote to provide motivation for effective performance. With proximal goals, individuals are provided with standards to measure their performance more frequently. That is, "subgoal attainments provide clear markers of progress along the way to verify a growing sense of self-efficacy" (Bandura, 1982, p. 134).

Measurement

Given the task-specific nature of self-efficacy, measurement has been accomplished through the use of questionnaires designed on a study-specific basis. Several methods used for self-efficacy assessment are discussed, along with an initial review of self-esteem questionnaires. These were included in order to give direction regarding more global measures of the individual's self-concept. Recommendations for the creation of self-efficacy measures are provided to facilitate the development of scales that may be used to assess self-efficacy on a more general basis.

Global measures of an individual's self-perception may be obtained through the use of instruments that assess self-esteem. The Adjective Checklist (ACL) (Gough & Heilbrun, 1965) contains 300 adjectives from which individuals choose those that they feel are self-descriptive. Test-retest reliabilities have been demonstrated to range from .63 to .73 (Robinson & Shaver, 1973). The ACL has been found to correlate at .38 with the California Personality Inventory. Although the scale contains 300 adjectives, administration time is typically only about 15 minutes. Robinson and Shaver (1973) do not recommend this particular scale for the assessment of self-esteem since there are others available that are more specific.

The Self-Esteem Scale (Rosenberg, 1965) measures the degree of an individual's self-acceptance. The questionnaire contains 10 items that are to be answered on a 4-point scale ranging from strongly agree to strongly disagree. Test-retest reliability is .85 and the scale correlated .59 with the Coopersmith Self-esteem Inventory. Although the scale is brief, it is thorough in its assessment of self-acceptance (Robinson & Shaver, 1973).

The Coopersmith Self-Esteem Inventory (Coopersmith, 1967) measures individuals' self-evaluative attitudes. Although the scale was originally developed for use with children, it has since been revised to be used with all ages. The 25-item final version of the scale is the result of an item analysis of the original 50 items, and the shorter form correlated .95 with the longer version. Respondents are to indicate the degree that each item is like or unlike them. A .90 split-half reliability was computed for the scale in its longer form, although none has been computed for the shorter version. Robinson and Shaver (1973) report correlations of the scale with the Self-esteem Scale of .60. A factor analysis yielded four factors: leadership-popularity, self-derogation, assertiveness-anxiety, and a family-parents factor. Of these, the most stable was the family-parents factor. This scale appears to effectively assess its particular areas. However, less attention seems focused on the individual's

Technical Report 92-012

self-acceptance, and the questions that address family issues are probably less relevant for the Navy's purposes.

The Tennessee Self-Concept Scale (Fitts, 1964) was derived from other scales and originally consisted of 90 statements. These 90 statements were subsequently classified by clinical psychologists into five self-concept categories: the family self, physical self, moral/ethical self, personal self, and social self. Ten items from the Minnesota Multiphasic Personality Inventory (MMPI) lie scale were also included. Respondents indicate on a one-to-five scale the degree that the statement is true for them (one being completely false and five being completely true). A total self-esteem score may be derived from the scale, as well as subscores for each of the above areas. In addition, a self-acceptance score across all areas and a variability score that reflects differences in esteem across the areas may be computed. The test-retest reliability of the scale is .92, and ranges from .70 to .90 for the subscales (Robinson & Shaver, 1973). The scale has been found to correlate at -.70 with the Taylor Manifest Anxiety Scale. Although the scale contains 100 items, test administration time is approximately only 20 minutes.

In contrast to the measures that assess global self-esteem, self-efficacy is measured in relation to a specific task. For this reason, the measurement of self-efficacy is typically accomplished through questions created specifically for the task at hand. Bandura (1977) describes the assessment of efficacy expectations on the dimensions of strength, level, and generality. Performance tasks were ranked in order of difficulty and rated by subjects on a 100 point scale, in 10-unit intervals, on their perceived level of certainty for the performance of each task. Feltz, Landers, and Raeder (1979) used this format in the design of their questionnaire that assessed individuals' self-efficacy regarding a diving task. A test-retest reliability of .98 for one week was computed for their Diving Efficacy Scale (DES) with a sample of seven college students. The questions required the subjects to rate their expectancies regarding their confidence in each of the 8 tasks, from 0 to 100 percent (e.g., ability to jump off a 1-m board feet first, ability to dive off the side of the pool).

Weinberg, Gould, and Jackson (1979) assessed self-efficacy beliefs regarding a motor-performance task through the use of three questions. Subjects rated their self-confidence on a scale of 1 to 7 (1 being extremely low and 7 being extremely high), the frequency of self-talk (1 being never and 7 being always), and how many trials out of 10 they believed they could win.

Technical Report 92-012

In both of these investigations researchers developed their own measurement instruments. Given that self-efficacy is by definition a task-related construct, this is inevitable. In order to develop effective self-efficacy scales it is necessary to first delineate the integral components of the task. Once this has been accomplished, items should be written that address individuals' self-perceptions regarding their ability to perform the task's components and be ranked by level of difficulty. Likert scale type responses should be used rather than forced choice formats in order to allow variation of response across subjects, because it would appear that self-perception exists in degrees rather than simply being there or not. Subjects can be asked to decide if they are capable of completing the task and to rate the certainty of their answer. Once the scales are developed they may be administered to a group of subjects in order to establish reliability and validity. Measures of internal consistency and test-retest reliabilities can be computed and validity can be established by attempting to relate the scale to preexisting related measures. By following these guidelines researchers should be able to develop appropriate measures of self-efficacy. Perhaps the development of psychometrically sound questionnaires would eventually permit their shared use for particular tasks.

Implications for Team Level Interaction

The CIC team implications for self-efficacy are similar to those for perceived control. It is hypothesized that CIC teams high in self-efficacy regarding their component of the team's decision making task will exhibit better performance under stress than teams composed of low self-efficacy individuals. It is also hypothesized that there may exist a "collective efficacy" construct that refers to the degree that teams perceive themselves as being effective as a whole regarding their tasks (Travillian, Baker, & Cannon-Bowers, 1992). Teams with high collective efficacy would likewise be hypothesized to demonstrate superior performance in comparison to teams with low collective efficacy. Furthermore, these collective efficacy estimates will correlate more highly with overall team performance than will the summed self-efficacy measures of individual members.

SELF-CONTROL

Another moderator that appears promising for application to team tactical decision making research is self-control. The self-control construct has been described as "a learned repertoire of cognitive skills by which an individual self-regulates internal events" (Gal-Or, Tenenbaum, Furst, & Shertzer, 1985, p. 743). It has been suggested that individuals who use self-control in the management of their pain, thoughts,

Technical Report 92-012

or emotions are able to implement measures that reduce the negative effects of their maladaptive behaviors (Rosenbaum, 1980). Thus, it appears that the effective use of self-control may result in improved coping skills in stressful situations.

Gal-Or et al. (1985) investigated the effects of self-control and anxiety on performance in 44 trainee parachutists. The authors hypothesized that self-control would be a more important predictor of performance than anxiety, and that high anxiety subjects would not perform as well as low anxiety subjects. The authors expected subjects low in anxiety and high in self-control to exhibit the best performance. Consistent with this hypothesis, subjects high in self-control, regardless of trait anxiety, performed better than subjects low in self-control. But, contrary to the authors' hypothesis, the best performance was exhibited by individuals who were high in both self-control and anxiety. Subjects high in anxiety and low in self-control had the poorest performance. This study suggests that self-control may be an even stronger predictor of performance than anxiety.

Rosenbaum and Rolnick (1983) examined the relationship between an individual's use of self-control behaviors and seasickness. Eighty-nine sailors from the Israeli Navy served as subjects. Individuals were assessed for the presence of seasickness and self-control behaviors, and peer evaluations yielded measures of performance deficits. Low and high self-control individuals who were not seasick did not differ in their performance, nor was there a difference in susceptibility to seasickness for high and low self-control subjects. However, consistent with the authors' hypothesis, high self-control subjects suffering from seasickness had fewer deficits in performance and reported the use of more self-control methods to cope with their discomfort than did low self-control subjects. Consistent with the research of Gal-or et al. (1985) self-control measures taken by the subjects facilitated better performance under stressful conditions.

Measurement

The self-control construct, as defined by Rosenbaum (1980), has gained a degree of empirical support within the literature. As such, the scale he developed is reviewed below. Although the construct's definition and use is obviously open to reinterpretation and revision, at the present time Rosenbaum's scale appears to assess self-control as he defines it.

The questionnaire most often associated with the assessment of self-control in the literature is the Self-Control Schedule (Rosenbaum, 1980). This instrument was developed in order to

Technical Report 92-012

assess the individual's tendency to utilize self-control methods in solving behavioral problems. The questionnaire contains 36 items that assess perceived self-efficacy, the ability to delay immediate gratification, the application of problem solving strategies, and the use of self-statements and cognitions to control physiological and emotional responses. The items were generated as follows: twenty items were written that referred to tasks that required self-controlling responses, thirty that referred to an unpleasant physiological or emotional experience, and ten that indicated a general belief in self-control. These items were then given to two behaviorally oriented clinical psychologists who evaluated the items according to comprehensibility, generalizability, and the degree that the item reflected the effective use of a self-controlling response. From this evaluation, 44 items were chosen for an item analysis using a Likert scale format. The empirical analysis of the scale resulted in the deletion of eight items that did not conform to the experimenter's criteria. Test-retest reliability of .86 was computed for a four week period and internal consistency coefficients ranged from .78 to .84 for five samples. A measure of validity was obtained by way of comparison with the Rotter I-E Scale. It was hypothesized that individuals high in self-control would be internal in their locus of control. A Pearson correlation of $-.40$ ($p < .01$) was computed between the Self-Control Schedule and the Rotter scale. This indicates that individuals who reported greater use of self-control methods believed less in the external control of their behavior. Subjects who were high scorers on the Self-Control Schedule were also better able to tolerate and control noxious stimuli. This questionnaire appears to be a valuable one in the assessment of self-control. A 36-item scale is an acceptable length in regards to time for administration and the Likert format allows for variability in individual response. The psychometric properties are also acceptable. For these reasons, this questionnaire is recommended for the assessment of self-control.

Implications for Team Level Interaction

The self-control implications for teams are especially salient in relation to issues regarding training and appear particularly useful for CIC decision making teams. It is hypothesized that teams composed of members high in self-control will exhibit better decision making performance under stress than CIC teams with low self-control members. Those CIC teams trained to use cognitive and self-statements to control emotional and physiological responses, apply problem solving strategies, delay immediate gratification, and increase self-efficacy will display better decision making performance than teams with no such training.

ANXIETY

Anxiety has been defined as: "...internally generated cycles of connotative signals elicited by external stimuli, that a central interpreting or appraisal process codes as requiring avoidance, and as indicating physical danger, injury to self-esteem, rejection, and loss of affection in valued social settings." (Hamilton, 1975, p. 50). Spielberger (1972) also differentiates between state anxiety and trait anxiety. State anxiety is an emotional state that is transitory in nature. It varies in intensity and consists of feelings of apprehension, tension, and increased autonomic nervous system activity. State anxiety also varies over time. In contrast, trait anxiety refers to individual differences in anxiety predispositions that are relatively stable. Trait anxiety may be conceived of as a susceptibility to respond to situations perceived as threatening with an increased intensity of state anxiety. This differentiation between trait and state anxiety allows more exacting research regarding the effects of anxiety under stress.

Anxiety has been examined for its effects on performance in relation to the Yerkes-Dodson hypothesis (Evans, 1979). This hypothesis states that performance increases with arousal up to a certain point after which any further increase in arousal becomes detrimental to performance. The results of past tests of this hypothesis have proven to be equivocal. Weinberg and Ragan (1978) hypothesized that part of the difficulty in these studies lies in the creation and manipulation of arousal in the laboratory setting. Past research (i.e., Hodges & Spielberger, 1969) has indicated that direct or implied threats to self-esteem due to evaluation are effective in producing arousal. Weinberg and Ragan (1978) also report that indirect support for the hypothesis has been provided in motor-behavior studies. The application of this research to the military environment is readily apparent. Knowledge regarding the point that stress level begins to inhibit, rather than facilitate, performance would be especially applicable to potentially high stress military occupations. Further information regarding the moderating impact of individuals' predispositions to anxiety would provide direction for selection and training.

Weinberg and Ragan (1978) provided evidence for the moderating impact of trait anxiety on performance. They tested the motor performance of 420 undergraduates under conditions of arousal that were created by manipulating threat to self-esteem due to evaluation. Subjects at three levels of trait anxiety were required to perform a motor task under each of three different levels of psychological stress. The study yielded significant results with respect to the effects of stress on performance and regarding the moderating impact of trait anxiety

Technical Report 92-012

on performance under varying levels of stress. Subjects in the low stress group had the poorest performance. The performance of individuals in the moderate stress group was significantly better than that of individuals in either the high or low stress conditions, thereby supporting Weinberg and Ragan's hypothesis. Individuals who were high in trait anxiety performed best under low stress conditions, while individuals low in trait anxiety performed best under high stress. In other words, level of trait anxiety appeared to influence the level of stress required for optimal performance. This finding suggests potentially useful applications for selection and training. In many situations, Navy personnel are required to perform motor tasks under conditions of psychological stress. With knowledge of individuals' preexisting anxiety levels, they may be assigned to tasks that would facilitate their best performance under stress. Training may be useful in order to enable the anxiety prone individual to maintain performance when under stress. Further investigation is needed to establish the applicability and viability of this model.

Archer (1979) explored the relationship between locus of control, state anxiety, and trait anxiety. He hypothesized that subjects' ratings of situational control would significantly interact with locus of control. Seventy-two undergraduate students were recruited to test this interactionist model. While the results did not indicate a significant interaction between situational control and locus of control, the interactionist position was supported by other findings. A significant interaction was discovered between situational control and trait anxiety, such that high trait anxiety subjects in the ambiguous control condition reported a significantly lower expectancy of avoiding shocks than subjects with low trait anxiety in the same condition. These results indicated that trait anxiety was predictive of individual's behavior in a situation that was ambiguous, but not in those conditions with clear and explicit situational cues regarding the contingencies of reinforcement. The author argues that these findings provide support both for the interactionist model and for the relationship of trait anxiety as a determinant of individuals' cognitive expectancies over control in situations of aversive stimulation. Therefore, these results provide implications for further research. The possibility that individuals who differ in trait anxiety levels may differ in their perception of their own effectiveness in particular situations, that may in turn affect performance, should be explored as well.

Measurement

The State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, & Lushene, 1970) is the most widely used anxiety

Technical Report 92-012

measurement instrument in stress research. The instrument is a two-part scale that assesses both state and trait anxiety. Each part contains 20 items that either indicate an absence of anxiety or describe anxiety symptoms. The trait scale requires that individuals indicate on a four-point scale the frequency of times that they experience anxiety symptoms, while the state scale calls for ratings of intensity of anxiety symptoms at a particular time (Spielberger, Vagg, Barker, Donham, & Westberry, 1980). The test-retest reliabilities of the trait scale ranged from .73 to .86, while the reliabilities for the state scale were expectedly low, ranging from .16 to .54 (Anastasi, 1976). The Kuder-Richardson reliabilities for both scales ranged from .83 to .92. Validity has been established via factor analysis which has yielded a single trait factor and three state factors (Gaudry, Vagg, & Spielberger, 1975). Likewise, Kendall, Finch, Auerbach, Hooke, and Mikulka, (1976) factor analyzed the scale and distinguished one trait factor and two state factors. These authors concluded that the trait scale measures fear of failure or loss of self-esteem, while the state factors measure different levels of state intensity.

Another measure that assesses trait anxiety is the Taylor Manifest Anxiety Scale (Taylor, 1953). This instrument was constructed by having clinicians rate 200 items from the Minnesota Multiphasic Personality Inventory (MMPI) on the degree that they were indicative of manifest anxiety. Of the 200, 50 were eventually chosen as the anxiety measurement items. These true/false items address somatic, physiological, and cognitive aspects of stress reactions. In addition, the scale contains 175 buffer items derived from the MMPI. Test-retest reliability has ranged from .81 to .89 (Taylor, 1953). Overall, the scale is a valuable one, however its desirability for research regarding stress and performance is questionable given its length. The scale's items are written with qualifiers (e.g., often, practically never) that attempt to control for the true/false format of the scale. However, it would appear that anxiety would best be measured on a continuum. For these reasons this scale is not recommended.

The STAI appears to be the most promising anxiety measurement instrument for research regarding stress and decision making performance. It is commonly used and its reliability, validity, and length all contribute to its acceptability. The ability of the scale to distinguish between trait and state anxiety also contributes to its usefulness for stress/performance research. This anxiety distinction will enable researchers to isolate the particular reaction of interest and focus their attention as such. For all of the above reasons, the STAI appears to be the most valuable anxiety measurement instrument.

Implications for Team Level Interaction

The team implications of anxiety are hypothesized to correspond to the Yerkes-Dodson hypothesis raised to a team level. That is, team anxiety implications should be considered in relation to environmental stress demands. CIC teams comprised of team members who experience low levels of trait anxiety will exhibit better performance than teams with members with high anxiety levels under high stress conditions. Likewise, teams composed of members with moderate levels of trait anxiety will perform better than teams with low trait anxiety under low stress conditions.

EXPERIENCE

The moderating impact of experience on stress has also been explored, to a somewhat lesser degree than previously described variables. Experience has been investigated in two different ways: (a) prior experience with a given stressor has been investigated in relation to the effects of that stressor, and (b) the stress/performance relationship has been examined in situations where experience relates to the task to be completed. In general, such studies indicate that previous experience results in lowered stress response and predictability of performance.

Klonowicz (1989) investigated the relationship between reactivity (i.e., trait anxiety), experience, and response to noise. Noise experience was defined as frequent or long exposure to street noise. Noise experience was hypothesized to interact with reactivity to determine performance on a proofreading task under noise stimulation load. The interaction between stimulation load and reactivity was significant with high reactivity individuals having increased errors under increased stimulation load and low reactivity subjects having better performance under increased stimulation load. The interaction between reactivity and experience proved to be significant, with students from noisy schools with high reactivity having less errors than high reactivity students from quiet schools. The authors state that noise experience is especially helpful for high reactivity persons, while the performance of low experience persons decreases under conditions of increased stimulation load. In this instance noise experience in association with reactivity served to moderate the relationship between stress and performance.

Norris and Murrell (1988) explored the effectiveness of prior experience as a moderator of anxiety symptoms in response to disaster in older adults. Anxiety measures of residents who experienced the flooding of southwestern Kentucky were obtained.

Technical Report 92-012

The authors hypothesized that less distress would be experienced by individuals who had previously been exposed to the stress of floods. Consistent with their hypothesis, little stress was observed in the older adults who had been in floods before, while those for whom flooding was novel experienced more severe stress. This provides support for the viewpoint that prior experience with a stressor moderates its effects.

Bricton, McHugh, and Naitoh (1974) investigated the relationship between experience and landing performance under various levels of workload. Total flying experience was significantly predictive of landing performance during the low cumulative workload condition. Under moderate cumulative workload, specific aircraft experience was the strongest predictor of landing performance. However, under high cumulative workload conditions, experience was not predictive of performance. The authors note that stable factors such as specific aircraft experience have more predictive ability for average landing performance than do more changeable factors. The authors hypothesized that the moderating effects of experience are inhibited during high workload for older, more experienced pilots. This research lends support to the theory that experience moderates the relationship between stress (i.e., workload) and performance, especially at low and moderate levels of stress.

It is hypothesized that lack of experience may function as an additional stressor in otherwise stressful situations. As reported by Jorna and Gaillard (1988), this additional stressor (lack of experience) may be exhibited in terms of increased physiological arousal. These researchers investigated the information processing performance and physiological reactions of experienced and non-experienced divers in both a dry control condition and in an actual open water dive. Non-experienced subjects were Dutch Naval divers who were undergoing an intensive 8-week shipdiving training. They made three open water dives: during the first, fourth, and seventh week of the training. The experienced subjects were divers with an average of 75 hours of diving experience. Their open water dives were performed at the same time as the first and third dives of the inexperienced divers. The information processing task consisted of identifying test letters of a previously memorized list. Physiological responses were measured in terms of heart rate, blood pressure, and energy level (derived from electronic monitoring of cardiac activity). Performance did not differ for experienced and inexperienced divers in the dry control condition. However, in the first open water dive, inexperienced divers' performance was inferior to that of experienced divers, but this difference was no longer evident at the time of the final dive. Jorna and Gaillard concluded that "it is possible for an inexperienced

Technical Report 92-012

diver to maintain a performance level equal to more experienced divers, as long as the task is not highly loaded" (Jorna & Gaillard, 1988, p. 57). It was also concluded that it was the interaction of the underwater environment and the experience level that led to the differences in performance. Results also indicated that heart rate decreased by the end of training for the inexperienced divers and energy levels were increased. The authors argued that the difference between groups on the heart rate measure may have occurred due to differences in physical fitness level. Since the diver training has been shown by medical examinations to improve physical fitness, the change in heart rate would, thus, be accounted for. This research lends support to the idea that lack of experience may serve as a stressor in an already stressful situation. It was apparent that there was an improvement in performance on the information processing task and less physiological reactivity to the stress of the diving situation. The authors questioned the generalizability of the study and suggested that future research should investigate the role of experience in more complex and dangerous situations.

Measurement

Of all the moderators identified as most salient, experience appears to be the most simplistic in terms of measurement. Experience can be conceived of as a discrete or continuous variable, depending on the needs of the researcher. The following paragraph provides some guidance for the measurement of experience.

The assessment of experience can best be accomplished through the utilization of demographic type questionnaires developed by researchers. Depending on the type of experience, whether with the stressor or with the task, the questionnaire should reflect the variability of individual experience (i.e., how much rather than simply obtaining yes or no answers regarding prior experience). These measurement instruments may range from one to many questions, depending on the degree of detail desired by the researcher.

Implications for Team Level Interaction

The implications for CIC teams in regard to experience may refer to stressor experience and/or task experience. It is hypothesized that CIC teams composed of team members with greater exposure to a particular stressor will display less performance decrement under stress than teams with no prior exposure to the stressor. Training interventions designed to increase experience with a stressor (i.e., simulations, stress inoculation training)

Technical Report 92-012

will prevent performance decrements under stress in comparison to teams with no training.

CIC teams comprised of members with high task experience should perform significantly better than teams comprised of members with little or no prior task experience. It is also likely that teams with both prior task and stressor experience would display optimal performance. As noted above, high fidelity simulations (in terms of the task and the stressor) should act to engender this experience. Also of potential importance is the degree to which experience with particular team members influences performance. However, this relationship remains to be established.

Technical Report 92-012

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CONCLUSIONS

The literature indicates that in order to obtain an understanding of the relationship between stress and performance, it is necessary to identify and investigate variables that may alter or obscure the effects of stress. The moderators identified in the research literature that should be taken into consideration for TADMUS research are social support, locus of control, perceived control, self-efficacy, self-control, trait anxiety, and experience. At varying levels, these moderators may have the potential to increase or decrease the effects of stress on performance. For example, social support tends to act as a buffer against stress. When social support contributes needed resources to the individual its effects are ameliorative. These resources have both a quantitative and qualitative dimension in that social support must be present in critical quantities and address particular needs.

It can be argued that a common construct is shared among many of the moderators (e.g., self control, perceived control, self-efficacy, locus of control, and trait anxiety). Although they each describe a different construct on the surface, it may be that each one is related to the same principle. We suggest that each of the seven salient moderators function by empowering the individual with a subjective sense of control whereby performance is facilitated. Self-efficacy and self-control are more cognitive mechanisms, and the presence or absence of trait anxiety may determine the individual's predisposition to respond to stress with a perceived lack of control. By definition, locus of control refers to the extent that people feel controlling of or controlled by the events in their lives. It appears that each of these moderators is actually related to the same principle of causality, but approaches its investigation from a different angle.

Although the concept of control is less apparent with such variables as social support and experience, a case can be made for their relationship to perceived control. The determining factor regarding the effectiveness of social support relates to the degree that the individual is the recipient of useful resources. This, in turn, arms the individual with increased control over the situation. Likewise, prior experience with a stressor or task equips individuals with coping strategies which in turn increase their ability to control stressor effects.

Theoretical and empirical work by Kanfer and Ackerman (1989) provides support for the idea that the degree of control that individuals perceive themselves as having over stress is a factor in determining their reaction to the situation. Their work suggests that performance of tasks that require hypothesis

Technical Report 92-012

generation, option selection, and target identification may be affected by stress in several ways. Among the possible reactions to stress are cognitive, motivational, and affective reactions. With this theoretical basis in mind, it is apparent that increased control perceptions would serve to minimize the effects of cognitive, motivational, or affective reactions. For example, an increased perception of control would serve to alleviate the detrimental effects of stress on decision making by preserving problem solving and decision making functions, regulating attention and effort, and allaying emotional reactivity in accordance with the theory derived by Kanfer and Ackerman (1989).

While the literature provides the beginnings of an understanding of moderators of the stress-performance relationship, an important caveat is that, aside from social support, most of the moderators identified are individual difference variables. Although such factors as perceived control and trait anxiety are useful in understanding stress and performance at the individual level, application to CIC tactical team level interactions requires empirical investigation. In addition, it should be noted that there may be other moderators not yet researched that could have an important impact on team level interactions. Therefore, in order to obtain the most benefit from research regarding CIC tactical team decision making, it is necessary to: (a) recognize critical moderators, (b) develop effective moderator measurement procedures, and (c) analyze findings in order to statistically control for moderators.

RECOMMENDATIONS

Recommendations made in the next two sections are based on the conclusions discussed above. Recommendations for current TADMUS research focus on statistical control of moderator variables in initial experiments. Recommendations for future TADMUS research focus on both methodological and conceptual issues that need to be addressed in order to develop an understanding of how the moderators influence the stress-performance relationship.

CURRENT TADMUS RESEARCH

Very little is known regarding the influence of the moderators identified in this report on the relationship between stress and team tactical decision making performance. Therefore, the implications of moderators for current TADMUS research should relate to the issue of statistical control and exploratory analysis. The research indicates that perceived control, self control, self-efficacy, and experience significantly moderate the relationship between stress and performance. By utilizing the guidelines and recommendations for appropriate measurement given at the end of each moderator section, an assessment of each of the moderators should be obtained. For example, measures of perceived control can be utilized in current TADMUS research with subsequent covariation of its effects through statistical analysis. This would allow a clearer examination of the relationship between stress and tactical decision making performance by removing the variance associated with self-control perceptions. Initial findings should determine the degree to which these moderators influence the stress-performance relationship.

FUTURE TADMUS INVESTIGATIONS

Convergence of Moderator Variables

It was suggested that a number of the moderator variables may be interrelated. If this is so, then a conceptual understanding of how individual difference variables influence the stress-performance relationship must be established in order to make better predictions about it. TADMUS investigations may determine whether the moderators (e.g., self-efficacy, perceived control, self-control, locus of control, and trait anxiety) converge on a single common construct.

Interaction of Moderators with Stressors

It is possible that various moderators and moderator combinations may interact in different ways as a function of

stressor type. For example, noise overload may be an uncontrollable stressor and perceived control may not influence the relationship between noise and performance, but, experience with noise stress may influence the relationship. Therefore, relationships of moderators to various stressors should be explored because this would improve prediction of team and individual performance. In addition, it should be taken into consideration that moderators may interact with other moderators.

Implications For Designing Training Interventions

Initial estimates of moderator effects should provide an understanding of whether such variables as perceived control and self-efficacy may be trainable. For example, stress inoculation training (SIT) combines practice of stress coping skills with gradual exposure to stressors in order to improve experience with the stressors and to increase perceived control over the stressor. An important component of SIT is that it trains the individual to use thought control strategies in stressful conditions in order to maintain focus on the job or task (Novaco, 1975). SIT research has shown that it leads to improved performance on both cognitive and psychomotor tasks (Meichenbaum, 1985). For example, Hytten, Jensen, and Skauli (1990) found that oil rig trainees receiving SIT required less assistance in a smoke diving exercise than did a no-treatment control group. Thus, perceived control and increasing individual experience with the stressor are potentially trainable variables.

Although past research has focused primarily on the effects of naturalistic social support, it may be possible to train individuals to contribute social support as task-specific resources within their work group. Such training may serve to reduce the effects of stress on team tactical decision making performance. Thus, future research could focus on assessing task- and team-specific socially supportive behaviors and the utility of these behaviors in moderating the stress-performance relationship.

Other research indicates that self-efficacy may also be a trainable characteristic for individuals (Gist, 1989). On the other hand, given that trait anxiety is, by definition, a component of an individual's personality, it is probably not a trainable variable.

Technical Report 92-012

COORDINATION

TADMUS is a cooperative joint research program in human factors and training involving two principal laboratories: Naval Training Systems Center and Naval Command and Control Ocean Surveillance Center (NCCOSC). Main NCCOSC responsibilities are to develop general decision support and display principles to be evaluated in the context of anti-air warfare scenarios. Information, such as this report, is exchanged between NCCOSC and NAVTRASYS-CEN in order to advance understanding of joint TADMUS research efforts. Principal point of contact at NCCOSC is Jeffrey D. Grossman, phone number (619) 553-5302.

Technical Report 92-012

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Technical Report 92-012

TABLE 1 KEY

SUBJECTS	DESIGN	TASK
Civilian Female Male MiLitary Police Officers Student	Group Individual Teams	Cognitive Reaction Vigilance PsychoMotor Questionnaire Shock Avoidance Interview Problem Solving Coping Verbal Task Decision Making Tolerance TRaining ComPetition Tracking Task Manual Labor

Technical Report 92-012

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Table 1
Summary of Empirical Studies

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Role Stress	Job Enrichment	Field	89 M, F, C	I	Q	Results suggest that certain role stressors are more aversive for individuals on low-enriched jobs. Role ambiguity was the predominant source of stress for managerial-level personnel.	Abdel-Halim, A. A. (1978). Employee affective responses
Threat	Trait Anxiety	Lab	72 M, F, S	G	SA	Trait anxiety was found to be influential in the ambiguously structured condition but not in conditions that contained clear and explicit situational cues.	Archer, R. P. (1979). Relationships between locus of control
Lit Review							Baddeley, A. D. (1972) Selective attention and
Competition Performance	Self-Efficacy	Field	40 M, F, C	T	Q	There was a positive and significant relationship between self-efficacy and the performance of the tennis players.	Barling, J., & Abel, M. (1983). Self-efficacy beliefs and
Role Ambiguity	Autonomy	Field	651 M, F, C	I	I	The results suggest that autonomy is the strongest and most consistent moderator of the relationship between role ambiguity and role strain.	Beehr, T. A. (1976). Perceived situational moderators

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCES
Role Stress	Higher Order Need Strength	Field	79 M, F, C	I	Q	Higher order need strength moderates individually valued states, not organizationally valued states.	Beehr, T.A., Walsh, J.T., & Taber, T.D. (1976). Relationship of stress to.....
Workload	Teamize	Lab	24 M, F, C	I, T	PS	The results show an average decrease in workload of approximately 20% for two-man teams compared to individuals working alone.	Beith, B.H. (1987). Subjective workload under individual.....
Workload	Cumulate Workload, Experience	Field	26 M	I	V	Predictive ability of performance was greatly reduced in high cumulative workload conditions.	Brisson, C.A., McHugh, W., & Naitoh, P. (1974). Prediction of pilot performance.....
Lit Review							Brodbent, D.E. (1971). Decision and Stress.....
Life Events	Social Support	Lab	367 M, F, S	I	Q	The results suggest that gender, social support, and locus of control go beyond their direct effects on psychological adjustment and actually interact to reduce negative stressful life events.	Caldwell, R.A., Pearson, J.L., & Chin, R. (1987). Stress-moderating effects.....
Quantitative Workload	Role Ambiguity	Field	122 M, S	I	Q	Type A personality was most influenced by the stressors.	Caplan, R.D., & Jones, K.W. (1975). Effects of workload, role ambiguity.....
Lit Review							Cohen, S. (1980). Aftereffects of stress.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Lit Review							Cohen, S., & Wills, T.A. (1985). Stress, social support.....
Threat	Perceived Control	Lab	40 M, F, S	G	C	Perceived control reduced the aversive quality of the stimulus.	Coreh, N.L., & Boffa, J. (1970). Perceived control, self-observation.....
Occupational Stress	Social Support	Field	166 M, F, C	I	Q	The results suggest that workplace social support, in the job stress-burnout relationship, has preventive rather than remedial effects.	Digman, J.T., Barrera, M., Jr., & West, S.G. (1986). Occupational stress, social support.....
Occupational and Life Stress	Social Support	Field	657 M,F,C	I	Q	The effect of work stress on burnout was moderated by supportive work environments for men and supportive life sources for women.	Etzion, D. (1984). Moderating effect of social support.....
Crowding	Arousal Level	Lab	100 M,F, S	G	Q,C	Crowding acts as a stressor on human behavior and is mediated by over-arousal.	Evans, G.W. (1979). Behavioral and Physiological consequences.....
Threat	Type A	Lab	48 M,F, C	I	Q, R	Type A female demonstrated a choice of vigilant coping and heart-rate reactivity in the face of threat.	Evans, P. D., & Moran, P. (1987). The Framingham Type A Scale.....
Lit Review							Folkman, S. (1984). Personal control and.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Life Stress	Age	Field	141 M, F, C	G	Q, I	The results indicated there were age differences in coping with stress.	Folkman, S., Lazarus, R.S., Pines, S., & Novacek, J. (1987). Age differences in stress.....
Strong Physical Threat	Self-Control	Field	44 M, S	I	Q	Subjects high in trait anxiety and self-control performed the best, while subjects high in trait anxiety and low in self-control performed poorly.	Gal-Or, Y., Tennenbaum, G., Furst, D., & Shertzer, M. (1985). Effect of self-control.....
Noise	Control	Lab	18 W, C	G	C	The results show the ameliorative effects of perceived control on unpredictable noise.	Glass, D.C., & Singer, J.E. (1972). Urban stress.....
Combat Stress	Group Cohesion	Field	8,869 M, F, L	G	Q	Unit replacement companies scored significantly higher on all measures of unit cohesion used in this study.	Griffith, J. (1988). Measurement of group cohesion.....
Combat Stress	Group Cohesion	Field	3,245 M, F, L	G	Q	This study demonstrates that cohesion functions much like social support. Cohesion increases individual moral and acts as a buffer against stress.	Griffith, J. (1989). The army's new unit.....
Combat Related Stress (CRS)	Social Support	Field	716 M, L	I	Q	It was suggested that loneliness experienced in intense combat may increase the chances of soldiers developing CRS.	Hobfoll, S.E. (1988). The ecology of stress.....
Husbands Mobilized for War	Social Support	Field	56 W, C	I	CO	Social support was related to greater psychological distress due to a "pressure cooker" effect.	Hobfoll, S., & London, P. (1986). The relationship of self-concept.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Threat	Control, Locus of Control	Lab	66 M, F, C	G	Q, VT	Subjects in the threatening situation, with little control, experienced more anxiety than did those who had some control.	Houston, B.K. (1972). Control over stress.....
Performance Stress	Time Pressure	Lab	42, M, F, S	T	DM	Time pressure causes increased vertical structuring in small groups.	Ienbergh, D.G. (1981). Some effects of.....
Job Stress	Organizational Structure	Field	295 M, F, C	G	Q, I	Salesmen in the flat organization perceived more satisfaction and less anxiety-stress.	Ivanovich, J.M., & Donnelly, J.H. (1975). Relation of organizational.....
Lit Review							Ivanovich, J.M., & Matteson, M.T. (1980). Stress and work.....
Role Strain	Participation in Decision Making	Field	126 M, F, C	G	Q, DM	This study demonstrates the positive effect of participation on role strain.	Jackson, S.E. (1983). Participation in decision making.....
Life Stress	Locus of Control	Lab	124 M, F, S	I	Q	The results suggest that locus of control may be a moderator variable in the negative life change and depression/anxiety relationship.	Johnson, J. H., & Sarason, I. G. (1978). Life stress, depression.....
Occupational Stress	Need for Achievement	Field	92 M, F, C	I	Q	Need for achievement significantly moderates the relationship between task ambiguity and both intrinsic and overall satisfaction.	Johnson, T.W., & Stinson, J.E. (1975). Role ambiguity, role conflict.....
Pain	Self-Control	Study 1-Lab Study 2-Lab	45 F, S 75 F, S	G G	Q T	Subjects with control tolerated ice water immersion of the hand longer than subjects without control.	Kanfer, F.H., & Seidner, M.L. (1973). Self-Control: Factors.....
Failure Stress	Trait Anxiety	Lab	54 M, F, C	G	Q, C	Anxiety does not appear to be related to performance until the task itself becomes stressful.	Katchmar, L.T., Rosa, S., & Andrews, T. G. (1958). Effects of stress and anxiety.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Job Stress	Social Support	Field	102 M, F, C	I	T	Social support strengthened the relationship between job stressors and the subject's physiological and psychological strains.	Kaufmann, G. M., & Beehr, T. A. (1986). Interactions between job stressors.....
Physical Threat	Control	Lab	100 M, F, S	G	C	Controllability of the stressor was found to have no effect on the performance of the task.	Keinan, G. (1987). Decision Making under stress.....
Dental Anxiety	Self-Efficacy	Lab	198 M, F, C	G	Q	Low anxiety was associated with fewer negative thoughts and higher self-efficacy.	Kent, G., & Gibbons, R. (1987). Self-Efficacy and the control.....
Occupational Stress	Supervisor Support	Field	60 M, F, C, PO	I	M	Supervisor support moderated the relationship of load to both tension-anxiety and coping.	Kirmeyer, S.L., & Dougherty, T.W. (1988). Workload, tension and.....
Noise	Experience	Lab	20 F, C	I	Q	Experience with noise results in effective coping strategies.	Klonowicz, T. (1989). Reactivity, experience, and.....
Workload, Burnout	Social Support, Work Stress, Personal Accomplishment	Field	216 M, F, C	I	Q	Social support buffers the negative impact of workload on burnout. The evidence for a buffering impact of personal accomplishment was limited.	Koeske, G.F., & Koeske, R.D. (1989). Workload and burnout.....
Occupational Stress	Social Support	Field	3,725 M, L	I	Q	Social support from peers and leaders did not remove the negative influence of stress produced by conflict and ambiguity.	LaRocco, J., & Jones A. (1978). Co-worker and leader.....
Competition Stress	Self-Efficacy	Field	14, F, C	I	CP	The athletes' expectations regarding their performance were more accurate predictors of competition performance than were previous scores.	Lee, C. (1982). Self-efficacy as a predictor.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Life Stress	Social Support, Locus of Control	Study 1 - Lab Study 2 - Lab Study 3 - Lab	46 M, F, S 99 M, F, S 66 M, F, S	I I I	Q Q Q	Subjects with an internal locus of control seemed to derive the most benefit from social support.	Lefcourt, H.M., Martin, R.A., & Saleh, W.E. (1984). Locus of control and social.....
Role Ambiguity	Need for Clarity	Field	156 M, F, C	I	Q	The results suggest that the effect of role ambiguity on attitudes is moderated by the different needs for clarity of members within an organization.	Lyons, T.F. (1971). Role clarity, need for.....
Job Stress	Job Specificity, Locus of Control	Field	278 M, F, C	I	Q	Job specificity was positively related to job stress among internals and negatively related to stress among externals.	Marino, K.E., & White, S.E. (1985). Departmental structure.....
Life Events	Sense of Humor	Study 1 Lab Study 2 Lab Study 3 Lab	56 M, F, S 62 M, F, S 25 M, F, S	I I I	Q Q Q	It can be concluded from the results of the three studies that humor reduces the impact of stress.	Martin, R.A., & Lefcourt, H.M. (1983). Sense of humor as a.....
Workload	Age	Lab	30 M, C	G	V	Performance of older subjects tended to be lower and more sensitive to increases in workload.	Mertens, H.W., & Collins, W.E. (1986). The effects of age,.....
Job Stress	Need for Clarity	Field	180 M, F, C	G	Q	Need for clarity moderated the relationship between degree of role clarity and job tension for persons in nonsupervisory roles.	Miles, R.H., & Petty, M.M. (1975). Relationships between role clarity.....
Job Stress	Participation in Decision Making, Social Support	Field	756 M, F, C	I	Q	Participation had a substantial effect on the stress-burnout relationship. The effects of social support were limited.	Miller, K.I., Ellis, B.H., Zook, E.G., & Lylea, J.S. (1990). An integrated model.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Occupational Stress	Self-Esteem	Field	164 M, F, C	I	Q	Peer group interaction had a stronger effect on individuals with lower self-esteem than on those with high self-esteem.	Mosholder, K. W., Bedeian, A. G., & Armenakis, A. A. (1982). Group process-work.....
Flooding	Prior Experience	Field	234 M, F, C	I	I	It was shown that prior exposure to a stressor increases resistance to future stressors.	Norris, F. H., & Murrell, S. A. (1988). Prior experience as a.....
Life Events	Nationality	Field	316 M, C	G	Q	The results indicate that the men from the two different cities have distinctly different sources of stress.	Orth-Gomér, K. (1979). Ischemic heart disease.....
Shift Work	Circadian Type	Field	37 M, F, C	G	Q	The "morning group" had much more difficulty in adjusting to the shift schedule and the "evening" types had the least difficulty.	Ostberg, O. (1973). Interindividual differences.....
Heat	Incentive	Lab	16 M, L	I	TT	Performance in the unfavorable climate under the high incentive condition was no worse than performance in the most favorable condition.	Pepler, R. D. (1958). Warmth and performance.....
Lit Review							Perlmutter, L. C., & Monty, R. A. (1977). The importance of perceived control.....
Workload	Locus of Control	Lab	125 M, F, C	I	Q	Subjects with a high external locus of control reported less satisfaction and more stress when workload was increased.	Perrewe, P. L. (1986). Locus of control and activity.....
Occupational Stress	Organizational Climate	Field	76 M, F, C	I	Q	Organizational Climate was strongly related to manager's satisfaction.	Pritchard, R. D., & Karasick, B. W. (1973). The effects of organizational.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Pain	Self-Control	Study 1-Lab Study 2-Lab	40 M, F, C 54 M, F, C	G G	Q, C, T Q, T	High self-control subjects consistently tolerated the cold pressor longer than low self-control subjects.	Rosenbaum, M. (1980). Individual differences in.....
Seasickness	Self-Control Skills	Field	89 M, L	I	Q	Seasick subjects who were high in self-control performed better than those low in self-control.	Rosenbaum, M., & Rolnick, A. (1983). Self-control behaviors and.....
Negative Life Events	Locus of Control	Lab	93 M, F, S	I	Q	Locus of control beliefs moderated the effects of stress.	Sandler, I. N., & Lahey, B. (1982). Locus of control as a.....
Job Stress	Leader Structure, Leader Consideration	Field	54 M, F, C	I	Q	Leader structure was related to reduced subordinate performance under conditions of low stress. Leader consideration resulted in increased satisfaction and performance under low stress.	Schriesheim, C.A., & Murphy, C. J. (1976). Relationships between leader.....
Role Stressors	Organizational Level	Field	391 M, F, C	G	Q	Role ambiguity and role conflict were negatively related to job satisfaction at all three levels in the organization but had varying effects on performance.	Schuler, R. S. (1975). Role perceptions, satisfaction.....
Role Stressors	Organizational Level, Participation in Decision Making	Field	392 M, F, C	G	Q	Role ambiguity and participation and role conflict and participation significantly interacted at the lower level of the organization.	Schuler, R. S. (1977). Role perceptions, satisfaction.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
N/A	Self-Esteem	Lab	270 M, F, C	G	Q, C	When faced with a problem-solving task, groups with a moderate level of self-concept did the best.	Schwartz, T.M., Wulwick, V. J., & Shapiro, H. J. (1980). Self-esteem and group.....
Continuous-work	Age, Physique	Lab	28 M, C	G	M, L	Continuous work capacity did not decrease with increasing age, however, physique had a greater effect on continuous work capacity during slower, heavier tasks.	Snook, S.H. (1971). The effects of age.....
Threat	Control	Lab	89 M, S	I	Q, VT	Control decreased the subject's anxiety only when little effort to control was required.	Solomon, S., Holmes, D.S., & McCaul, K.D. (1980). Behavioral control over.....
Combat Related Stress (CRS)	Social Support	Field	716 M, L	G	Q	Soldiers who experienced intense battle stress and little unit support reported an increased likelihood of developing CRS.	Solomon, Z., Mikulincer, M., & Hobfoll, S.E. (1987). Objective vs. subjective measurement.....
Lit Review							Spector, P. E. (1986). Perceived control by.....
Time Pressure, Social Threat	Reactivity	Lab	175 M, C	I	DM, R	Low-reactive pilots made quicker, more accurate decisions in stressful situations.	Strelau, J., & Maciejczyk, J. (1977). Reactivity and decision making.....
Performance Stress	Physical Fitness	Lab	40 M, F, C	I	Q, DM, T	Physical fitness training led to an increase in the efficiency of performance on decision making tasks.	Svoniainen-Troyer, S., Davis, K.J., & Jamail, A. H. (1986). Impact of physical.....
Job Stress	Control	Field	206 M, F, L	I	Q	Understanding and control were found to moderate the negative relationship between perceived role stress and satisfaction.	Tetrick, L.E., & LaRocco, J. M. (1987). Understanding, prediction, and

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Lit Review							Thomas, E. J., & Fink, C. (1963). Effects of group size.....
Lit Review							Thompson, S. C. (1981). Will it hurt if I can.....
Role Stressors	Influence, Organizational Stress	Field	488 M, F, C	I	Q	The ability to influence decisions about one's job or position was positively associated with higher levels of job satisfaction. The relationship between participation and job satisfaction was significant only under a low stress condition.	Tosi, H. (1971). Organization stress as a.....
Job Stress	Physical Fitness	Field	4,628 M, C	I	Q	The results suggest that among middle-aged men, stress levels are related to general physical fitness.	Tucker, L.A., Cole, G.E., & Friedman, G.M. (1986). Physical fitness: A buffer.....
Combat Related Stress	Group Cohesion/Command Style	Field	94 M, L	I	Q	Performance was positively affected by the interaction of group cohesiveness and command style.	Tziner, A., & Vardi, Y. (1982). Effects of command style.....
Threat	Locus of Control	Lab	433 M, F, S	I	Q	It was concluded that the primary appraisal of threat and/or challenge is an interaction of the person variable (Internal-External) and the appraised stressor.	Vitaliano, P.P., Russo, J., & Maiuro, R.D. (1987). Locus of control, type.....
Threat	Trait Anxiety	Lab	420 M, S	G	Q, CP	High-trait-anxious subjects performed best under low stress, whereas low-trait-anxious subjects performed best under high stress.	Weinberg, R.S., & Ragan, J. (1978). Motor performance under.....
Competition Stress	Self-Efficacy	Lab	96 M, F, C	I	CP	The results suggest that self-efficacy can be modified to improve motor performance.	Weinberg, R.S., Gould, D., Yukelson, D.T., & Jackson, A. (1981). The effect of pre-existing and.....

Table 1 (Continued)

STRESSORS	MODERATOR	SETTING	SUBJECTS	DESIGN	TASK	SIGNIFICANT FINDINGS	REFERENCE
Competition Stress	Self-Efficacy	Lab	112 M, F, S	G	CP	In a face-to-face competitive situation, high self-efficacy subjects performed better than low self-efficacy subjects.	Weinberg, R.S., Yutelson, D., & Jackson, A. (1980). Effect of public and private.....
Noise	Sleep Deprivation, Knowledge of Results	Lab	24 M, L	I	R	Sleep deprivation reduced the effect of noise on performance, while knowledge of results increased the effect of noise on performance.	Wilkinson, R.T. (1963). Interaction of noise with.....

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